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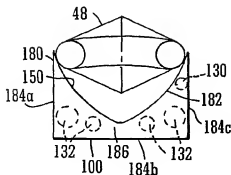
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(54) Title: LAUNCH AND RECOVERY APPARATUS AND METHOD



(57) Abstract: Apparatus for the launch and recover of boats (48), submersibles and the like includes a support (182) surface and a mounting means for attachment to a fixed structure. The apparatus is rendered buoyant in the water, for example by including inflatable and deflatable members (130, 132).

Launch and Recovery Apparatus and Method

The present invention relates to an apparatus and method for the transfer of an entity to or from water. Transfer of an entity is primarily the launching and recovery of boats, in particular small boats such as RIBs (rigid inflatable boats, also known as rigid hull inflatable boats or RHIBs), but may also, or alternatively include the movement of people into and out of water, for example during leisure activities or in emergency situations. Such boats are typically used in coastal and inshore and inland waters for leisure, for transfer of personnel, as rescue boats and lifeboats and may be used in deep waters for the transfer of personnel, goods and equipment between vessels and between a vessel and a fixed installation, such as an oil rig, gas rig or wind turbine.

The invention also relates to an apparatus and method for launching and recovery of autonomous underwater vehicles (AUVs), so-called "free swimming vehicles", submersibles and the like (hereinafter collectively referred to as submersibles) or boats, from larger vessels.

Conventionally, from land, boats and the like are launched down a permanent slipway, which is perfectly acceptable where suitable slipways are available. However, there are numerous occasions where no suitable slipway is available at the chosen launch location. Typically this might occur when the boat to be launched is being used for leisure purposes and where, for example, emergency rescue services wish to launch a boat near to the location of an emergency.

The launching of boats and submersibles from vessels at sea is often limited by the prevailing weather and sea conditions. Where the prevailing wave height is too high, launching can become impossible and this leads to an expensive loss of working time.

Conventional boat and/or submersible launching and recovery systems for use at sea tend to use davits or cranes and the like, and these normally require complex compensation or stabilisation systems to account for movement of the launch vessel and the launched boat or submersible caused by the weather and sea conditions.

- 5 Often, boats and submersibles are slid up and down the side of the launch vessel as they are lifted on launch and recovery. This carries the risk of damage to the boat or submersible, or to the launch vessel. To avoid impact between the launch vessel and the boat or submersible, cranes or A-frames with considerable outreach are normally required, to provide necessary clearance between the payload (the boat or
10 submersible) and the launch vessel.

- For launch and recovery of a boat or submersible at sea, it is also known to use slipway like structures mounted at the side or rear of the launch vessel. The boat or submersible is launched and recovered via the slipway structure while the vessel
15 moves forwards. Typically such a slipway structure will consist of a rigid metal ramp, which is pivoted to the rear of the vessel. Examples of such slipway structures are described in the July 2003 edition of "Sea Technology" (Compass Publication Inc, Arlington, VA, USA). Slipway structures of this type tend to be rigid and have a low tolerance of misalignment with the boat or submersible being launched
20 recovered. Accidental damage to the boat or submersible by collision with the slipway structure is a significant problem. Further, conventional systems do not normally permit safe access by which for personnel may pass down the slipway structure.

- 25 For the recovery of boats and, in particular, submersibles it is normally necessary to attach a lift rope. Often, this must be done manually, and providing safe access for personnel to leave the launch vessel and attach the lift rope is also a problem. A similar problem occurs on launch when the lift rope must be detached.
- 30 Accordingly, the present invention seeks to provide an apparatus for launching a relatively small vessel or submersible in locations where no convenient slipway is

available, or for launching a small vessel or submersible from a ship at sea. For example, the apparatus of the present invention will allow a boat to be launched from the quayside, sea wall, harbour wall or the like. The present invention further seeks to provide an apparatus for launching a relatively small vessel or submersible which
5 is resiliently deformable, at least in part, whereby any collision damage with the launched vessel or submersible is minimised or obviated.

According to a first aspect of the invention there is provided an apparatus for transfer of an entity to or from water, the apparatus comprising:

- 10 i. a support surface, along which the entity being launched or recovered is operatively moveable;
- ii. at least one buoyant component operative to render the apparatus buoyant in water; and
- 15 iii. mounting means disposed at a first end of the apparatus, for pivotally mounting the apparatus on a fixed structure.

The buoyant component, or the buoyant components in total, is/are sufficient to ensure that when an upper end of the apparatus is attached to a fixed structure and a lower end of the apparatus is in its operative position, the lower end floats at or near
20 (e.g. just below) the water surface

Transfer of the entity is most preferably launch or recovery of a boat, submersible or the like, but the apparatus of the invention may also be used for providing access for people into and out of water, or for providing access from, say, a vessel to a boat,
25 submersible or the like in water.

In a first embodiment of this aspect of the invention, the apparatus comprises a supporting body, at least part of an upper surface of which defines the support surface. The supporting body may have safety rails attached thereto.

30

Preferably in this embodiment the at least one buoyant component is disposed within the supporting body.

5 Preferably in this first aspect of the invention, the apparatus comprises a plurality of longitudinally extensive buoyant members arranged within the supporting body.

10 In preferred constructions the at least one buoyant component comprises first and second longitudinally extensive side members operatively arranged in substantially parallel spaced apart relation.

Preferably in this construction the apparatus further comprises spacing means operative to maintain the side members in parallel spaced apart relation.

15 Preferably the spacing means comprise or include inflatable and deflatable members.

In one configuration the side members are disposed within the supporting body.

20 In another, more preferred, configuration the longitudinally extensive side members are external to the supporting body and attached to the supporting body at respective sides thereof.

25 Preferably the side members each comprise or include at least one longitudinally extensive buoyant member. More preferably the side members include at least two such buoyant members. This construction provides for redundancy in the case of failure of one of the inflatable members.

30 In particularly preferred arrangements the longitudinally extensive buoyant members are operatively transformable from a compact state suitable for transport and storage of the apparatus to an expanded operative state.

In one variation of this arrangement the buoyant members comprise a low density buoyant material. Preferably the buoyant members comprise a foam material and more particularly a compressible resilient foam material. The buoyant members in this variation are preferably operatively inflatable and deflatable.

5

More generally, the buoyant members are preferably operatively inflatable and deflatable. In a preferred example the buoyant members comprise one or a plurality of inflatable bladders or chambers. The bladders are fluid tight (the fluid preferably being air) and are provided with one or more valves through which they are inflated and deflated. When the buoyant members are inflated, the respective side members are resiliently deformable (for example, on impact), while having sufficient resistance to bending and distortion to allow the apparatus to carry a vessel or submersible.

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15 In a second, preferred, embodiment the apparatus comprises:

- (a) first and second longitudinally extending side members, each comprising at least one buoyant member; and
- (b) spacing means operatively configured to maintain the respective first and second side members in spaced apart relation.

20

Preferably the spacing means operatively maintain the side members in substantially co-planar relation.

Preferably the spacing means operatively maintain the side members in substantially parallel relation.

25

In some variations of this second embodiment of the invention the support surface comprises, or includes, a portion of the outer surface of the side members.

30 In these and/or other variations the support surface comprises, or includes, a portion of the outer surface of the spacing means.

In preferred variations of the second embodiment the support surface extends between the respective first and second side members.

- 5 One preferred construction according to the second embodiment of the invention provides, in summary, an apparatus for transfer of an entity to or from water (more especially for launch or recovery of a boat, submersible or the like) comprising:
- i). first and second longitudinally extending side members, each comprising at least one buoyant member;
 - 10 ii). spacing means adapted to maintain the respective first and second side members in spaced apart relation;
 - iii). a support surface, extending between the respective first and second side members; and
 - iv). mounting means disposed at a first end of the apparatus, for pivotally mounting
 - 15 the apparatus on a fixed structure.

Preferably in the second embodiment of the invention the support surface comprises, or includes, a web of supporting material disposed between the side members.

- 20 Most preferably in this second embodiment of the invention each side member comprises a pair of buoyant members.

Preferably each side member comprises longitudinally extensive buoyant members having a length substantially equal to that of the side members.

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Preferably in this second embodiment of the invention, the side members are operatively transformable from a compact state suitable for transport and storage of the apparatus to an expanded operative state.

- 30 In one variation, the buoyant members comprise a low density buoyant material such as a foam material and more especially a compressible resilient foam material.

Preferably the buoyant members in this variation are operatively inflatable and deflatable.

- 5 More generally, in a preferred construction of the apparatus according to the second aspect of the invention, preferably the buoyant members are operatively inflatable and deflatable. In a preferred example the buoyant members comprise one or a plurality of inflatable bladders or chambers. The bladders are fluid tight (the fluid preferably being air) and are provided with one or more valves through which they are inflated and deflated.

10

Most preferably when the buoyant members are inflated, the respective side members are resiliently deformable and have sufficient resistance to bending and/or distortion to allow the apparatus to carry a boat, submersible or the like.

- 15 Preferably in the second embodiment of the invention, the spacing means are operatively inflatable and deflatable.

Preferably in the second embodiment, the respective side members comprise at least two inflatable members. This construction provides for redundancy in the case of
20 failure of one of the inflatable members.

Preferably in constructions according to the first aspect of the invention the apparatus comprises at least one walkway traversable by user.

- 25 Preferably the walkway comprises non-slip means.

In one preferred construction the walkway is defined by an upper surface of a side member.

- 30 In another preferred construction the walkway is supported by an upper surface of a side member.

Preferably in constructions according to the first aspect of the invention which include side members, one or both of the side members has safety rails attached.

- 5 A second aspect of the present invention provides a vessel including an apparatus as defined in the first aspect of the invention.

- A third aspect of the present invention provides a moveable land based construction, more especially a motor vehicle, configured to carry an apparatus as defined in the
10 first aspect of the invention.

- A fourth aspect of the present invention provides a trailer for towing by a motor vehicle and configured to carry an apparatus as defined in the first aspect of the invention.

- 15 The mounting means may be attached to, mounted on, or may be a part of, the fixed structure. The fixed structure may be a permanent land structure such as a sea wall, harbour wall, quayside or the like, or may be a larger vessel. Also the fixed structure may be a moveable land based structure such as a road (and/or off-road) vehicle, or a
20 trailer towed or towable by such a vehicle.

- For a better understanding of the invention and to show how the same may be carried into effect, reference will be made, by way of example only, to the following drawings in which:

- 25 Figures 1A and 1B are schematic cross-sections through an apparatus according to one embodiment of the invention in respectively contracted and expanded configurations;

- 30 Figure 2A to 2D are schematic cross-sections through variations of the embodiment of Figure 1;

Figures 3 and 4 are respectively schematic cross-sections through an apparatus according to another embodiment of the invention;

- 5 Figures 5 is schematic cross-section through an apparatus according to a further embodiment of the invention;

Figure 6 is a side view of an apparatus according to Figure 6;

- 10 Figure 7 is a plan view of an apparatus according to Figure 6; and

Figures 8A to 8D show stages in launching a boat using the apparatus of the invention.

- 15 Referring now to the drawings, the apparatus 100 shown in Figures 1A and 1B according to a first aspect of the invention is shown having a boat 48 such as an RIB carried thereon. The apparatus 100 comprises a supporting body 180 which defines a support surface 182 which the boat 48 operatively traverses. The supporting body further comprises one or more external walls 184a, 184b, 184c. A greater or lesser
20 number of walls 184 may be provided. The walls may, or may not, enclose a space 186. For example, in the latter case the walls may have attached to the internal faces thereof a plurality of buoyant members an example of which is shown schematically at 130. Where the walls 184 enclose space 186, the space 186 is provided with a plurality of buoyant members 132 which may, or may not, be attached to walls 184
25 and/or underside of supporting surface 182. Preferably the number and size of the buoyant members 132 is selected to substantially fill the space 186. The buoyant members 130, 132 are longitudinally extensive and extend preferably for substantially the whole length of the apparatus 100. The apparatus 100 may adopt expanded and contracted configurations. In the expanded configuration, the
30 apparatus 100 is ready for use, and, in the contracted configuration, the apparatus 100 can more easily be transported or stored. To this end, most preferably, the buoyant

- members 130, 132 comprise inflatable and deflatable members in the form of chambers, bladders, tubes or the like. With the inflatable members 130 or 132 inflated, the supporting body 180 of the apparatus 100 is provided with bending strength (that is, resistance to bending under load), and also sufficient buoyancy. The
- 5 supporting body 180 may be provided with ropes, stays and the like to enhance its strength and stiffness and to assist with controlled inflation, deflation, deployment and stowage. Figure 1A illustrates the apparatus 100 in a deflated, or partially deflated state. Figure 1B illustrates the apparatus in an inflated, operational, state.
- 10 The support surface 182 is preferably provided by a web of material 150. Such material 150 forming the support surface 182 (whether a web extending across the whole area of the apparatus 100 or otherwise) preferably comprises a tough (i.e. cutting and tear resistant) low friction material, such as a nylon fabric or other plastic material. "Low friction" in this sense means that a boat 48 or submersible may slide
- 15 easily over the material. The walls 184 may also be formed from similar material thus forming an "envelope" around the buoyant members 130 or 132.

- In the variation of the first embodiment illustrated in Figure 1B, the support surface 182 has a generally V-shaped configuration which conforms approximately to the
- 20 underside of the boat 48. Depending on the intended use of the apparatus 100, the support surface 182 may have other configurations. For example the support surface may be substantially flat.

- The support surface 182 may be discontinuous. If so, its extent must, of course, be
- 25 sufficient (or the magnitude of the discontinuities must be sufficiently small) adequately to support the boat or submersible during passage up and down the apparatus 100. The support surface preferably, but not essentially, extends across the whole width of the apparatus between the respective sides indicated by side walls 184a, 184c.
- 30

In variations of this embodiment of the invention, the support member may be provided with side members 12, 14. The side members 12, 14 are substantially the same as those described below in connection with further embodiments of the invention. Variations of the first embodiment of the invention including such side members 12, 14 are shown in Figures 2A to 2D. In Figures 2A and 2B, the side members 12, 14 are contained within the supporting body 180.

In the construction according to Figure 2A, the side members 12, 14 typically provide all, or a majority of, the structural strength of the apparatus. Other buoyant (preferably inflatable) members 132 may be provided within the space 186, of which only one example is indicated, and if present will contribute additional strength and/or buoyancy.

In the construction according to Figure 2B, buoyant (inflatable) members 132 are typically absent. Spacing means 16 are provided which maintain the side members 14, 16 in spaced apart parallel relation. The spacing means 16 are as described below in connection with subsequent embodiments of the invention. Also, underlying structural elements 34 may be provided to provide additional strength and support to the support surface 180. Again, the underlying structural elements 34 are as described in connection with subsequent embodiments of the invention below. Both the spacing means 16 and the underlying structural elements 34 are configured to extend laterally across the apparatus 100. The underlying structural elements 34 and the spacing means may be, but are not essentially, arranged substantially perpendicular to the side members 12, 14. The underlying structural elements 34 and spacing means 16 are preferably inflatable and deflatable to allow the apparatus 100 to transition between its expanded and contracted configurations.

The construction according to Figure 2C is analogous to that of Figure 2A, but the side members 12, 14 are in this case separate components distinct from, but suitably joined to, the supporting body 180. The supporting body 180 is otherwise as described in relation to Figure 2A. In Figure 2C the space between the side members

12, 14 and the adjacent wall 184 of the supporting body 180 is exaggerated for clarity of illustration.

- Similarly, the construction according to Figure 2D is analogous to that of Figure 2B,
5 but again the side members 12, 14 are separate components distinct from, but suitably joined to, the supporting body 180.

- Referring now to Figures 3 and 4 the apparatus 10 of another embodiment of the invention comprises first and second side members, 12, 14 and spacing means 16.
10 Each side member comprises one or more inflatable members, and in the illustrated embodiment the side members 12, 14 each comprise two inflatable members (20, 22) (24, 26) in side-by-side relation. More specifically the respective inflatable members (20, 22) (24, 26) are arranged one above the other. Each inflatable member may comprise a single inflatable chamber or bladder, preferably in the form of a
15 longitudinally extensive tube. Alternatively, the inflatable members may comprise an outer skin enclosing a plurality of inflatable tubes. In this case, preferably the inflatable tubes are independently inflatable. Thus, if one or two of the inflatable tubes fail the remaining inflatable tubes are sufficient to maintain buoyancy and load-bearing rigidity of the apparatus 10. Where more than one inflatable member (20, 22,
20 24, 26) is provided preferably each inflatable member is independently inflatable. Typically, the inflatable members and/or the inflatable tubes are inflated to a pressure of about 1 bar.

- The side members 12, 14, when inflated, provide the apparatus with bending strength
25 (that is, resistance to bending under load), and also help to ensure that the apparatus is sufficiently buoyant. The side members 12, 14 may be provided with ropes, stays and the like to enhance their strength and stiffness and to assist with controlled inflation, deflation, deployment and stowage.

- 30 Between the respective side members 12, 14 spacing means 16 are arranged. The spacing means 16 serve to maintain the side members 12, 14 at the correct spacing

and in the correct orientation with respect to each other. In principle, any suitable spacing means 16 may be used such as metal, wood or plastic rods, bars or spars, but in a preferred arrangement the spacing means 16 are themselves inflatable and preferably comprise a number of inflatable tubes or struts 30, which (in their inflated state) span the gap between the side members 12, 14. The inflatable tubes 30 are constructed to have sufficient rigidity and bending strength to hold the side members, 12, 14 in their spaced apart relation during use. Alternatively, the spacing means 16 may be a single inflatable "beam" which extends substantially along the whole functional length of the apparatus 10.

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In Figure 3 the spacing means are shown in a compact (non-inflated) state, suitable for transport of the apparatus 10. It can be seen that in this state the overall width of the apparatus is relatively small, so that the apparatus 10 (and the boat 48 mounted above it) can conveniently be conveyed by road. Inflation of the spacing means 16 causes the apparatus 10 to adopt the wider configuration shown in Figure 2.

15

The apparatus 10 preferably further comprises structural elements 34 preferably in the form of inflatable tubes which are similar to inflatable tubes 30 and are provided to support the boat 48, submersible or the like during its passage along the apparatus. In this configuration, upper parts of the structural elements 34 provide a support surface 18 which operatively contacts the boat 48, submersible or the like. In another configuration, the structural elements 34 are absent and the boat 48, submersible or the like contacts directly the spacing means 16. Thus in this case the support surface 18 is an upper surface of the spacing means. This construction is particularly appropriate when the spacing means 16 comprises a single inflatable "beam" which extends substantially along the whole functional length of the apparatus 10.

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The apparatus 10 may alternatively include, in a further configuration, one or more webs of material 50 which form a support surface 280 (shown as a ghost line), which is disposed between the side members 12, 14. The support surface 280 provides the surface along which the boat or submersible slides during the launch and recovery.

30

- Underlying structural elements 34 preferably in the form of inflatable tubes which are similar to inflatable tubes 30 are provided to support the web of material 50. Most preferably the material 50 forming the support surface 280 (whether a web extending across the whole area of the apparatus or otherwise) comprises a tough (i.e. cutting and tear resistant) low friction material, such as a nylon fabric or other plastic material. "Low friction" in this sense means that a boat or submersible may slide easily over the material. The support surface is preferably continuous but may alternatively be discontinuous. Where the support surface 280 is discontinuous, its extent must, of course, be sufficient (or the magnitude of the discontinuities must be sufficiently small) adequately to support the boat or submersible during passage up and down the apparatus. The support surface 280 preferably, but not essentially, extends across the whole width of the apparatus between the respective side members 12, 14.
- A further embodiment of the apparatus 200 is shown in Figure 5. This embodiment is similar to that of Figure 4 and like components are given like reference numbers. The structural elements 34 are absent. The support surface 380 is provided by a component 250 which extends between the side members 12, 14 and which may be a web of fabric which is the same as, or similar to, web 50 in Figure 4. Alternatively, the component 250 may have the support surface 380 provided by a material which is the same as, or similar to, that of web 50, but further include integral strengthening or supporting elements. For example, the component 250 may have integrated supporting elements in the form of inflatable members similar to supporting elements 34. The component 250 may typically have a "sandwich" construction in which such supporting elements are arranged between upper and lower webs of material having properties similar to that of material 50. The component 250 and consequently the support surface 30 support surface is preferably continuous but may alternatively be discontinuous. Where the support surface 380 is discontinuous, its extent must, of course, be sufficient (or the magnitude of the discontinuities must be sufficiently small) adequately to support the boat or submersible during passage up and down the

apparatus. The support surface 380 preferably, but not essentially, extends across the whole width of the apparatus between the respective side members 12, 14.

The apparatus 10, 100, 200 of the invention further includes mounting means
5 disposed at an upper end in use and which are used to secure the apparatus 10 to a fixed structure. The fixed structure may be a structure on land (such as at a quayside, harbour wall or sea wall), a mobile land-based structure such a road vehicle (motor vehicle) or a trailer towable by a road vehicle, or may be a vessel at sea. The mounting means may be mounted on, attached to, or may be a part of, the fixed
10 structure. The mounting means are constructed to allow the apparatus 10, 100, 200 of the invention to pivot with respect to the fixed structure about a nominally horizontal axis and, preferably, also about a nominally vertical axis. In this way, up and down movement of the apparatus 10, 100, 200 caused by action of waves on the lower end of the apparatus 10, 100, 200 when in water is accommodated, as is lateral
15 movement of the apparatus 10, 100, 200 with respect to the launch vessel or the shore. The freedom of movement about the horizontal axis may also allow some downward movement of the apparatus as a boat or submersible is recovered onto the apparatus, as the apparatus accommodates the weight of the boat or submersible, and a corresponding upward movement as the boat or submersible leaves the apparatus
20 on launch. The mounting means or fixed structure may desirably carry or otherwise include a winch and cable for controlling the movement of a boat, submersible or the like on the apparatus 10, 100, 200. In the case of a land based apparatus, the winch may be mounted on the trailer, or may, for example, be mounted on, and powered by, the towing vehicle. The mounting means and/or fixed structure may also include
25 rollers or other constructions which facilitate the movement of the boat or the like onto or off the apparatus 10, 100, 200. In addition, tie-down or lashing points may be provided on the mounting means to secure the boat, submersible or the like.

The apparatus 10, 100, 200 of the invention further preferably comprises handrails or
30 safety rails 36 attached to the respective sides thereof. Typically, the handrails 36 comprise a plurality of uprights 38, attached to the respective side members 12, 14

and a top rail 40. Safety netting 42 may also be attached in the region of the handrails 36.

At one or both sides of the apparatus 10, 100, 200 a walkway 44 is preferably
5 provided by means of which personnel 46 may move up and down the apparatus 10, 100, 200. Simple and safe access by means of the walkway 44 is important in that it allows personnel 46 easily and safely to access the vessel (boat 48 or submersible) while the vessel is in the water. Thus, the walkway may be used so that personnel can descend to the vessel in order to attach a rope or cable by means of which the
10 vessel is moved up the apparatus 10, 100, 200 and by means of which movement of the vessel down the apparatus 10, 100, 200 can be controlled during launch. The walkway 44 may in its simplest form be an upper surface of one or more of the side members 12, 14. In this case, the upper surface of the side member 12, 14 is preferably provided with means to reduce the possibility of personnel 46 slipping on
15 the surface. Such means may be a high friction layer or coating or, for example, netting provided on the surface. In other constructions, a separate walkway resting on an upper surface of one of the side members 12, 14 may be used. Further, in some constructions it is possible for personnel to descend and ascend directly on the support surface 18.

20

The use of the apparatus 10, 100, 200 for the launching of a boat 48 from land is described with particular reference to Figures 8A to 8D and the apparatus 10 of Figures 3 and 4. The use of the apparatus of the Figures 1, 2, 5 and 6 follows the same principles and techniques.

25

In the illustrated example, apparatus 10 of the invention is initially mounted on a trailer 54 for conveyance of the apparatus 10 by road. The trailer 54 is towed by a suitable vehicle 56, but in alternative arrangements a self-powered vehicle carrying the apparatus may be employed. Initially, the trailer 54 is positioned at the point of
30 launch 58 which may be, for example, a quayside, sea wall, harbour wall or the like. In a preferred embodiment, the trailer forms the fixed structure to which the

mounting means of the apparatus is attached. In the illustrated embodiment, the mounting means are not shown. Likewise, although the apparatus 10 is shown detached in use from trailer 54, in preferred arrangements, the upper end 60 of the apparatus remains connected to the trailer 54, via mounting means. In general terms, the point of launch may be any convenient place above a body of water navigable by the boat 48.

If the apparatus 10 is already inflated, it is de-mounted from trailer 54 and lowered over the edge of the point of launch 58. The upper end 60 of the apparatus 10 is secured by mounting means (not shown) attached to the trailer 54 and the lower end 62 of the apparatus 10 rests at or near the water surface 64. Because of the inflation of the side members 12, 14 the apparatus 10 is inherently buoyant and so the lower end 62 floats at or near (i.e. below) the water surface 64. It is possible, in an alternative arrangement, for the apparatus, including the mounting means, to be entirely removed from the trailer 54 and for the mounting means to be secured to or on some other fixed structure (e.g. a harbour wall) before the apparatus is deployed.

The mounting means allows the apparatus 10 to pivot with respect to the point of launch 58 about a nominally horizontal axis and preferably also about a nominally vertical axis. Thus, the apparatus 10 can pivot about the horizontal axis to accommodate upward and downward movement caused by waves acting on the lower end 62 of the apparatus, and similarly caused by the weight of the boat acting on the apparatus 10. The apparatus 10 can move about the nominally vertical axis to accommodate movement caused by wind, tide, currents, impact and so on.

In one embodiment, the apparatus 10 is first securely deployed at the point of launch 58, and after that the boat 48 is moved onto the apparatus from the trailer. For example, the apparatus 10 and the boat 48 are initially both mounted on the trailer, such as at different levels on the trailer 54, thereby enabling the inflated apparatus 10 to be de-mounted from the trailer 54 independently of the boat. A cable or rope is secured to the boat 48 and may conveniently be attached at its other end to a winch or

the like. The cable and winch are used to control the descent of the boat 48 down the apparatus 10 into the water.

5 In an alternative embodiment, while on the trailer 54 the boat 48 is supported on the apparatus 10 (with the apparatus 10 in its inflated state) and the apparatus 10 carries the boat 48 as the apparatus is de-mounted from the trailer 54 and deployed. The movement of the boat 48 with respect to the apparatus 10 is controlled by a cable and winch arrangement as in the above embodiment, the cable being connected to the boat 48 before the apparatus is de-mounted from the trailer 54.

10

While on the apparatus 10 the boat 48 is supported by the support surface 18. Preferably the support surface 18 is shaped to conform, at least approximately, to the underside of the boat 48. Preferably the support surface 18 is approximately V-shaped in cross-section. The side members 12, 14 also provide support to the boat 48
15 and constrain its movement to a substantially linear path as the boat 48 slides down the support surface 18. When the boat 48 reaches the water, the cable or rope used to control the movement of the boat 48 is released and the boat 48 can move away from the apparatus 10 (Fig 5D). In order to release the cable from the boat 48 a crew member can conveniently and safely walk up and down the apparatus 10 using the
20 walkway 44. This may, of course, be done from the boat, where possible.

Where, prior to launch, the boat 48 is not already mounted on the apparatus 10 preferably means are provided whereby the boat 48 can slide (or otherwise be easily moved) from its location onto the apparatus 10. For example, the trailer 54 and/or
25 the mounting means may be provided with rollers which rotate as the boat 48 is moved over them.

In an alternative arrangement, the apparatus 10 may initially be in a compact, non-inflated state. In a particularly convenient arrangement, the apparatus 10 may be
30 stored and transported in its compact state on a boat carrying trailer, typically below the boat. When the apparatus 10 is required for use, the mounting means may be

secured in its position at the point of launch (e.g. the mounting means may (already) be secured to the trailer) with the apparatus 10 attached thereto. The apparatus is then inflated and so expands to span the gap between the point of launch 58 and water with the result that, as above, the upper end 60 of the apparatus 10 is secured
5 by the mounting means and the lower end 62 of the apparatus 10 floats at or near the water surface 64.

Where the boat 48 is launched from a vessel, the arrangement is similar. The apparatus 10 is mounted at its upper end 60 via mounting means to the launch vessel.
10 Again, the lower end 62 of the apparatus 10 floats at or near the water surface and the mounting means provide a nominally horizontal pivot to accommodate relative movement of the apparatus 10 and the vessel caused by the action of waves and the weight of the submersible. Preferably movement about a nominally vertical axis is also accommodated by the mounting means. Preferably, the launch vessel includes
15 rollers mounted on its deck over which the boat 48 moves prior to reaching the apparatus 10. The apparatus 10 may be disposed at the side of the launch vessel or, more preferably, the apparatus 10 may be mounted at the stern of the launch vessel. In the latter case, the boat 48 may be launched or recovered while the vessel is underway. Again, the apparatus 10 may be stored on the vessel in a compact,
20 deflated condition and inflated when required for use.

Preferably, for either launch from the shore or a launch vessel, the boat to 48 is manoeuvred using rollers of the like on to the apparatus 10 until (considering the slope in use of the apparatus 10) the boat 48 reaches its point of balance at which
25 stage the cable and associated winch are used to control the movement of the boat 48 and, normally, to restrain its movement down the slope of the apparatus 10 over the support surface 18. In a preferred method, the cable restraining the boat 48 is in the form of a bridle having to arms attaching to respective sides of the boat 48. If, as is preferred, the cable (via the bridle) is attached near to the centre of gravity of the boat
30 48, then the cable does not act to resist the rotation of the boat 48 from its nominally

horizontal attitude on shore (such as on trailer 54), or on the launch vessel, to its inclined attitude when on the apparatus 10.

- 5 When on the apparatus 10, most preferably, the boat 48 moves down the support surface 18 under the action of gravity and under the control of the cable and winch.

- Recovery of a boat 48 respectively onto land or onto the launch vessel follows generally the reverse of the above procedure. The boat 48 approaches the apparatus 10 and will normally present its bow between the side members 12, 14. The
10 apparatus 10 is able to move about the horizontal axis of the mounting means to moderate the effect of impact between the bow of the boat 48 and the apparatus 10. A crew member on the shore or the launch vessel can walk down the apparatus 10 bearing a cable which is then secured to the boat 48. It will be recalled that the other end of the cable is attached to a winch or the like. The cable and winch are then used
15 to pull the boat 48 up the apparatus 10 over the support surface 18. As soon as the cable is attached to the boat 48 so that is secured to the launch vessel winch or shore winch, the engine or motors of the boat 48 can be switched off.

- Use of the apparatus 10 of the invention for the launch and recovery of a submersible
20 or the like is in principle similar to the above described procedures. For launch, the submersible is allowed to slide down the apparatus 10 over the support surface 18 under the control of the cable and winch arrangement. When the submersible reaches the water a crew member can descend the apparatus 10 by walking down the walkway 44 in order to release the cable from the submersible. The submersible is
25 then free to continue its intended use.

- For recovery of the submersible, the submersible is made to approach the lower end 62 of the apparatus 10. A crew member then descends the apparatus 10 by the walkway 44 and attaches the recovery cable to the submersible. The cable and winch
30 are then used to pull the submersible up the apparatus 10 over the support surface 18.

The apparatus 10, 100, 200 of the invention has further important uses. In one such use, the apparatus 10, 100, 200 when deployed from a boat (or even from land) provides an easy means by which divers and swimmers can enter and exit the water. With the upper end 60 of the apparatus 10, 100, 200 pivotally mounted to the vessel
5 or a fixed structure on land, the lower end 62 floats at or below the water surface. This means that a portion of the support surface 18 towards the lower end 62 is immersed in the water. This lower end portion of the support surface 18 provides an "apron" extending above and below the water surface. Divers in the water can easily climb onto the surface 18 and ascend the support surface 18 to reach the
10 vessel. Similarly, the apron provides an area from which the divers can easily and safely enter the water. Because of the ability of the apparatus 10, 100, 200 to pivot about the axis (or axes) of the mounting means, relative motion between the apparatus 10, 100, 200 and the water and between the apparatus 10, 100, 200 and the vessel is minimised so that movement by divers etc onto and off the apparatus 10,
15 100, 200 at its respective upper and lower ends 60, 62 is easy. Access for divers into and out of the water is further improved if formations are provided on or near the apron which divers can grip with their hands. Such formations may also usefully provide footholds for divers and swimmers ascending the support surface 18. Useful formations in this respect include loops or straps of material attached to or near the
20 apron, incisions in the apron or netting provided on and near the apron.

The construction described in the above paragraph is further useful for the recovery of casualties from water, such as in seas or lakes. Often, such casualties are weakened by injury, exhaustion, heat or cold and are incapable of climbing up the
25 side of a vessel (normally use of nets or a pilot's ladder is necessary) to reach safety on the deck. By use of the apparatus 10, 100, 200 as described above the casualty can easily climb onto the apron area and then ascend over the support surface 18 and so onto the vessel deck. For casualties whose injury or illness is more severe, the apparatus 10, 100, 200 assists divers or other rescue personnel in recovering the
30 casualty since the casualty can be easily assisted or lifted on to the apron at the lower end 62 of the apparatus 10, 100, 200 and from there assisted or carried up to the

vessel by way of the support surface 18. This avoids the need to lift the casualty directly up the side of the vessel.

Further advantages of the apparatus 10, 100, 200 of the invention accrue from its
5 inflatable construction. At least the side members 12, 14 and preferably also the
spacing means 16 are inflatable. It follows that these components are resilient and
will deform resiliently on impact. Thus, on impact with a vessel, boat, submersible
or the like the apparatus 10, 100, 200 will deform resiliently and damage is not likely
10 to occur. Such impact can occur unintentionally in the case of a collision, or in the
normal course of events as a boat or submersible approaches the apparatus 10, 100,
200 for recovery. Similarly, because of the resiliently deformable nature of the
apparatus 10, 100, 200, it is less important to keep personnel out of the way of the
apparatus 10, 100, 200 during use since injury by impact with the apparatus is far less
likely to occur than with a conventional rigid apparatus.

15 Also, since the apparatus 10, 100, 200 is inflatable it can achieve a combination of
bending strength and a degree of flexibility which allow it to be both sufficiently
rigid to carry a boat or the like during launch and recovery whilst also being
sufficiently flexible to accommodate torsional stresses and strains due to wave
20 motion and the weight of the boat or submersible being launched or recovered. Thus,
the inflatable nature of the apparatus makes it tolerant of overload, excessive
deflections, impact and being twisted and pulled outside its designed freedom of
movement.

25 Because the apparatus 10, 100, 200 of the invention is inflatable it can be stored in a
compact, deflated condition. This makes the apparatus 10, 100, 200 easily portable
and convenient to store. Inflation of the apparatus may be effected by any suitable
inflation fluid, but the preferred inflation fluid is air. Air may be supplied from
compressed air cylinders or from a suitable pump or compressor. For deflation of the
30 apparatus 10, 100, 200 a pump is conveniently used.

By providing direct and safe access down the walkway 44 there is a considerably reduced need for personnel to enter the water to attach or detach cables or the like on recovery or launch of a boat, submersible or the like. This is an important safety benefit since it is inherently dangerous for crew to be in the water near to the boat,

5 submersible or the like.

Claims

1. Apparatus for transfer of an entity to or from water, the apparatus comprising:
 - 5 i. a support surface, along which the entity being launched or recovered is operatively moveable;
 - ii. at least one buoyant component operative to render the apparatus buoyant in water; and
 - 10 iii. mounting means disposed at a first end of the apparatus, for pivotally mounting the apparatus on a fixed structure.
2. Apparatus as claimed in claim 1 comprising a supporting body, at least part of an upper surface of which defines the support surface.
- 15 3. Apparatus as claimed in claim 2 wherein the at least one buoyant component is disposed within the supporting body.
4. Apparatus as claimed in claim 3 comprising a plurality of longitudinally extensive buoyant members arranged within the supporting body.
 - 20 5. Apparatus as claimed in 3 wherein the at least one buoyant component comprises first and second longitudinally extensive side members operatively arranged in substantially parallel spaced apart relation.
- 25 6. Apparatus as claimed in claim 5 further comprising spacing means operative to maintain the side members in parallel spaced apart relation.
7. Apparatus as claimed in claim 6 wherein the spacing means comprise or include inflatable and deflatable members.

30

8. Apparatus as claimed in claim 5, 6 or 7 wherein the side members are disposed within the supporting body.
- 5 9. Apparatus as claimed in claim 5, 6 or 7 wherein the longitudinally extensive side members are external to the supporting body and attached to the supporting body at respective sides thereof.
- 10 10. Apparatus as claimed in any of claims 5 to 9 wherein the side members each comprise or include at least one longitudinally extensive buoyant member.
11. Apparatus as claimed in claim 4 or 10 wherein the longitudinally extensive buoyant members are operatively transformable from a compact state suitable for transport and storage of the apparatus to an expanded operative state.
- 15 12. Apparatus as claimed in claim 10 or 11 wherein the buoyant members comprise a low density buoyant material.
13. Apparatus as claimed in claim 12 wherein the buoyant members comprise a foam material.
- 20 14. Apparatus as claimed in claims 13 wherein the buoyant members comprise a compressible resilient foam material.
15. Apparatus as claimed in claim 14 wherein the buoyant members are operatively inflatable and deflatable.
- 25 16. Apparatus as claimed in claim 11 wherein the buoyant members are operatively inflatable and deflatable.
- 30 17. Apparatus as claimed in claim 16 wherein the buoyant members comprise one or a plurality of inflatable bladders or chambers.

18. Apparatus as claimed in claim 1 comprising:
first and second longitudinally extending side members, each comprising at
least one buoyant member; and
5 spacing means operatively configured to maintain the respective first and
second side members in spaced apart relation.
19. Apparatus as claimed in claim 18 wherein the spacing means operatively
maintain the side members in substantially co-planar relation.
- 10 20. Apparatus as claimed in claim 18 or 19 wherein the spacing means
operatively maintain the side members in substantially parallel relation.
21. Apparatus as claimed in any of claims 18 to 20 wherein the support surface
15 comprises, or includes, a portion of the outer surface of the side members.
22. Apparatus as claimed in any of claims 18 to 21 wherein the support surface
comprises, or includes, a portion of the outer surface of the spacing means.
- 20 23. Apparatus as claimed in any of claims 18 to 21 wherein the support surface
extends between the respective first and second side members.
24. Apparatus as claimed in claim 23 wherein the support surface comprises, or
includes, a web of supporting material disposed between the side members.
- 25 25. Apparatus as claimed in any of claims 18 to 24 wherein each side member
comprises a pair of buoyant members.
26. Apparatus as claimed in claim 25 wherein each side member comprises
30 longitudinally extensive buoyant members having a length substantially equal
to that of the side members.

27. Apparatus as claimed in any of claim 18 to 26 wherein the side members are operatively transformable from a compact state suitable for transport and storage of the apparatus to an expanded operative state.
- 5
28. Apparatus as claimed in claim 27 wherein the buoyant members comprise a low density buoyant material.
29. Apparatus as claimed in claim 28 wherein the buoyant members comprise a
- 10 foam material.
30. Apparatus as claimed in claims 29 wherein the buoyant members comprise a compressible resilient foam material.
- 15
31. Apparatus as claimed in claim 30 wherein the buoyant members are operatively inflatable and deflatable.
32. Apparatus as claimed in claim 27 wherein the buoyant members are operatively inflatable and deflatable.
- 20
33. Apparatus as claimed in claim 32 wherein the buoyant members comprise one or a plurality of inflatable bladders or chambers.
34. Apparatus as claimed in claim 33 wherein, when the buoyant members are
- 25 inflated, the respective side members are resiliently deformable and have sufficient resistance to bending and/or distortion to allow the apparatus to carry a boat, submersible or the like.
35. Apparatus as claimed in any of claims 18 to 34 wherein the spacing means is
- 30 operatively inflatable and deflatable.

36. Apparatus as claimed in claim 5, 8 to 10, 18 or in any claim dependent thereon wherein the respective side members comprise at least two inflatable members.
- 5 37. Apparatus as claimed in any preceding claim further comprising at least one walkway traversable by user.
38. Apparatus as claimed in claim 37 wherein the walkway comprises non-slip means.
- 10 39. Apparatus as claimed in claim 37 or 38 when dependant on claim 5, 8 to 10, 18 or on any claim dependent thereon, or on claim 36 wherein the walkway is defined by an upper surface of a side member.
- 15 40. Apparatus as claimed in claim 37 or 38 when dependant on claim 5, 8 to 10, 18 or on any claim dependent thereon, or on claim 36 wherein the walkway is supported by an upper surface of a side member.
- 20 41. Apparatus as claimed in claim 5, 8 to 10, 18, 36 or in any claim dependent thereon wherein one or both of the side members, has safety rails attached.
42. Apparatus as claimed in claim 2 wherein the supporting body has safety rails attached.
- 25 43. A vessel including an apparatus as claimed in any preceding claim.
44. A motor vehicle configured to carry an apparatus as claimed in any of claims 1 to 42.
- 30 45. A trailer for towing by a motor vehicle and configured to carry an apparatus as claimed in any of claims 1 to 42.

46. Apparatus substantially as hereinbefore described with reference to any of Figures 1 to 9.

1/4

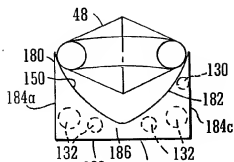


FIG. 1A

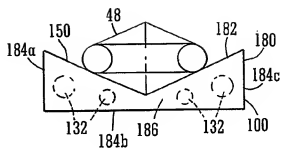


FIG. 1B

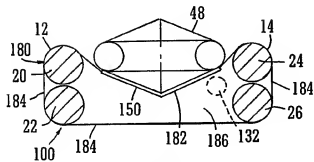


FIG. 2A

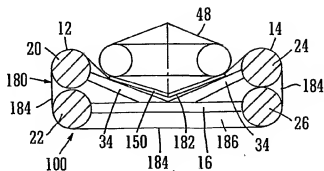


FIG. 2B

2/4

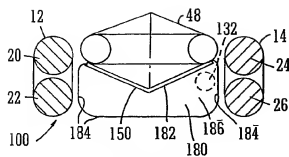


FIG. 2C

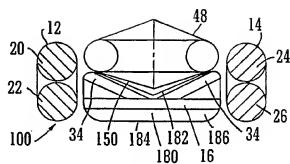


FIG. 2D

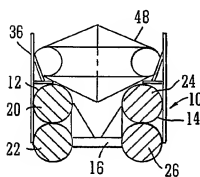


FIG. 3

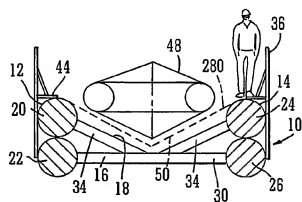


FIG. 4

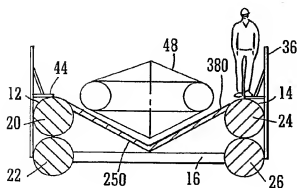


FIG. 5

3/4

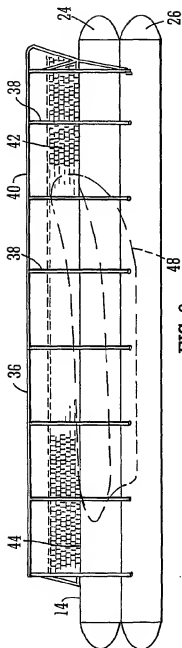


FIG. 6

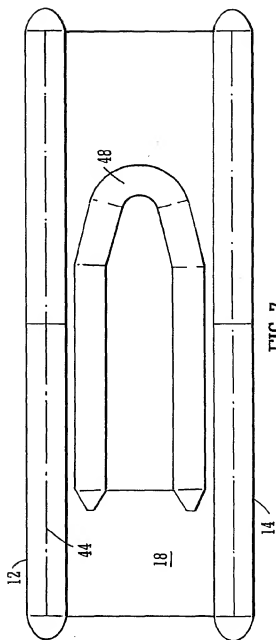
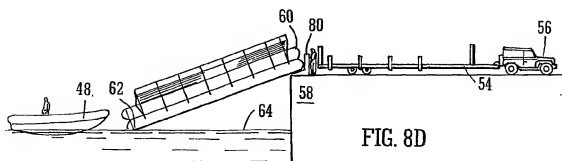
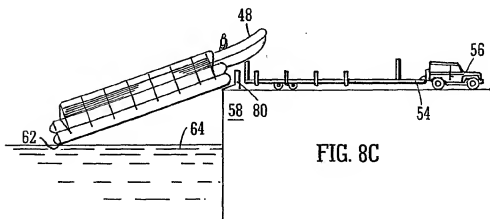
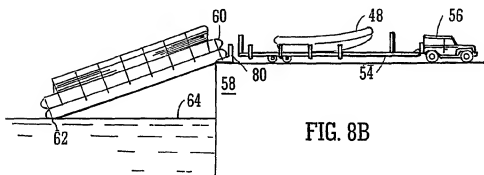
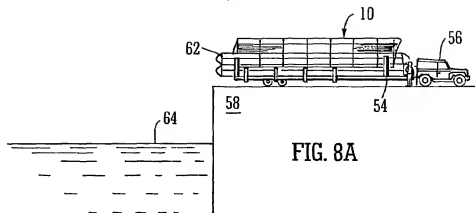


FIG. 7

4/4



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/000525

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B23/32 B63C3/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63B B63C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 286 346 A (WIEK ET AL) 1 September 1981 (1981-09-01)	1-12, 15-20, 23-25, 28, 44-46
Y	the whole document	13, 14, 21, 22, 26, 27, 29-40
X	EP 0 255 191 A (CONOCO INC) 3 February 1988 (1988-02-03)	1-3, 41-43
Y	the whole document	13, 14, 29, 30
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search

10 May 2006

Date of mailing of the international search report

19/05/2006

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/000525

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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information on patent family members

International application No

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